

THE AMERICAN X-RAY JOURNAL.

Devoted to Practical X-Ray Work and Allied Arts and Sciences.

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NO. 4.

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OBSERVATIONS ON CROOKE'S TUBES, ETC.

BY H. WESTBURY.

Read before the Roentgen Society of the United States, Grand Central Palace, Dec. 14, 1900.

One naturally feels some little difficulty in reading a paper at the present time on Crooke's Tubes, owing to the fact that the subject has already been covered very amply, and so far as our knowledge goes up to date, conclusively in the various scientific papers and lectures. However, as I believe that there are a number of observations that have been only moderately discussed, I trust that this paper will be of some interest.

As is well known, Professor Roentgen's discovery of the x-rays following up the experiments made by Hertz, Lenard, Crooke and others, was cabled to the *Sun* on January 6, 1896, although he had first observed the phenomena on November 8, 1895. All the leading scientists in this country were at once interested and proceeded to verify Professor Roentgen's assertions. I well remember the first time that Mr. W. H. Meadowcroft and myself produced x-rays. I think our feeling even then with the proof before our eyes was one of disbelief. We can all remember the interest taken by the public through the first months of 1896, together with the usual amusing surmises as to the possible use of the new discovery which appeared in the press. By about April,

1896, it was on a recognized footing, and gradually the various hospitals were adding x-ray facilities to their plant.

A few words on the cathode or ether ray and x-rays themselves:

Cathode rays are supposed to be produced at a pressure of about a millionth of an atmosphere. They are generated from any source of electricity with voltage high enough to force a discharge through a Crooke's Tube. They proceed perpendicularly from the surface of the cathode in straight lines and fall upon the opposite wall of the tube producing fluorescence. If any object be placed between the cathode and the opposite wall of the tube, a black shadow of the object is cast upon the wall of the tube. The path of the rays is entirely independent of the position of the anode. They can be deflected from their straight path by either pole of a magnet. Two parallel streams of cathode rays repel each other. If the rays fall upon a balanced object in the tube it will rotate. Making the cathode concave and so bringing the rays to a focus, heats the anode rapidly. The glass walls of the tube are opaque to the cathode rays. The x-rays are supposed to be produced at the same time as the cathode rays, originating at the end of the latter and passing out of the tube into the air. They produce fluorescence in certain chemical compounds such as T. of calcium, platino-cyanide of barium, etc. Wood, paper, cloth, metals, flesh, etc., are transparent

to the rays, although not to the same degree. They affect photographic plates, and thus give shadow photos of objects otherwise concealed. They are not believed to be light rays as they can not be reflected, refracted or polarized. Two views are held as to the nature of the cathode ray; one that these rays are a radiation in the ether, probably transverse waves like light, hence they are sometimes called ether waves; the other that they are streams of particles of the gas still left in the tube projected from the cathode. If, however, rays can be produced in a tube entirely free from air, it is evident that the second theory is incorrect. If there is left a small hole in a tube, and a thin plate of aluminum sealed in, the cathode rays pass out and can be deflected with a magnet. The first theory is well supported, but does not explain why a magnet deflects these rays or why two cathode streams repel each other, as nothing similar is known in light radiation.

It was early appreciated that the three things in which great improvements were necessary were the exciting apparatus, the fluorescing screen, and the Crooke's tube. With the first I have nothing to do in this paper. The screen has unfortunately stood practically where it started until now in spite of numerous experiments with all kinds of salts, of which the following have been found to fluoresce in varying degrees, viz:—

Platino, cyanide of barium, Tungstate of Calcium (these fluoresce better than any other salts at present known), Tungstate of strontium, subchloride of mercury, mercury diphenyl, cadmium iodide, sulphide calcium, potassium bromide, potassium iodide, tetrametaphosphate of lead, mercurous chloride, bromide and sulphate lead, fluorite, powdered lead glass, pectolite, sodium cressotinate, ammonia salicylate, calcium salicylate, salicylic acid.

Neither Tungstate of Barium or lead fluoresce appreciably. There are a large number of other chemical and mineral salts which also fluoresce but not to so great a degree as those above mentioned. Among these may be mentioned powdered German glass, barium fluoride, calcium fluoride, sodium fluoride, sodium chloride, mercuric chloride, cadmium chloride, silver chloride, lead chloride, lead iodide, sodium bromide, cadmium, lithia bromide, mercury, cadmium sulphate, uranium phosphate, nitrate of uranium (which fluoresces almost as well as tungstate of calcium), acetate of uranium, molybdic acid, silicate of potash, sodium bromide, wulfenite, orthoclase and alucite, hercynite, apatite, calcite, and many others.

Sulphide of zinc and sulphide of calcium can both be used for strengthening screens in contact with x-ray plates. I am afraid lists of chemicals are more or less tedious, but the above are interesting mainly from the fact that there is no doubt that improvements must be made in screens or tubes by the aid of such fluorescing salts, hence their importance.

Tungstate of calcium at first generally used for this purpose has been universally superseded by platino cyanide of barium, which, however, is extremely troublesome to handle, owing to its unstable nature, the least friction or dirt spoiling it. In my opinion, therefore, a cheaper and more durable fluorescing substance is much to be desired.

Harrison, N. J.

[To be continued.]

There is no way for any one to be technically or practically informed on the subject of x-rays unless he gets the matter from the AMERICAN X-RAY JOURNAL. We glean all there is from the entire world and publish monthly new matter, which every physician should read.

SOME HINTS FOR X-RAY WORKERS.

BY BENJ. F. BAILEY, M. A.

For some time past, experimental work has been carried on in the laboratory of electro-therapeutics at the University of Michigan, for the study and improvement of x-ray processes. We have a full equipment for this kind of work, including induction coils, two high tension, high frequency sets and two large static machines. I have worked a great deal with each of these and my own experience has been that I can do the best work with the induction coil in connection with the Wehnelt interrupter. Each method has its own special advantages and disadvantages. The Wehnelt interrupter is not so easy to handle as some other forms, but for difficult exposures my belief is that no other form can equal it. A considerable number of inquiries have convinced me that a need exists for some directions for practical work with this interrupter. I have, therefore, written this, hoping that it may help others to avoid some of the difficulties I have encountered.

Until recently, the Wehnelt interrupter has not been available in a form suitable for general use. The form here described works well, and seems to meet the requirements. The fundamental idea of the Wehnelt, and in fact, of all electrolytic interrupters, is to cause the current, somewhere in its path through the cell, to flow through a very narrow section of the liquid. There are several ways of doing this. One simple method is to interpose between the electrodes, an insulating barrier of glass or other suitable material pierced with a small hole. All the current is then forced to pass through the hole in its transit from one electrode to the other. The nature of the electrodes and of the solution, is of minor importance. It is evident that the resistance in the hole is very great, consequently, considerable heat

is developed there, and being applied to a small body of liquid, it heats it very rapidly. A bubble of steam forms and breaks the circuit, and is in turn almost instantly removed by condensation and by rising in the liquid, allowing the action to be repeated.

This is the Caldwell Interrupter and is really the fundamental form, the Wehnelt being a modification of it. The essential feature is the narrowing of the current stream, and in the Wehnelt Interrupter this takes place at the anode. The principle is the same as before, but in addition to the heat effect, we have the electrolytic effect. This complicates the phenomenon somewhat, and the presence of the electrolytic products prevents the interruption taking place at the cathode, but allows it to occur as well as before at the anode.

The practical method of accomplishing this narrowing of the current stream, is usually to seal a piece of platinum wire, about No. 18 in size, in the end of a glass tube, leaving about one-eighth of an inch projecting into the liquid. The tube is filled with mercury, to provide an easy connection with the leading in wire and to carry away the heat generated. The cathode may be any metal not attacked by the electrolyte. Lead is cheap and convenient and is generally used. A great number of electrolytes may be used. Sulphuric acid in water (one to four or five), is the solution usually used.

The interrupter so constructed, has grave faults, which completely prevent its use by the average x-ray worker. The greatest trouble comes from the platinum point cracking out of the glass on account of the severe heating to which it is subjected. The average "life" of this form of anode, is probably about ten minutes of actual use. Moreover, it is impossible to adjust the length of platinum exposed except by shortening it permanently.

A drawing of the form which I have finally adopted, is shown in Fig. 1, and a

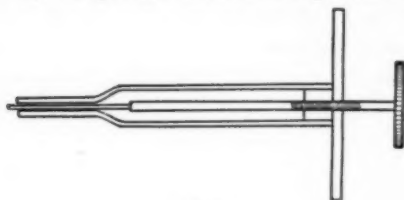


FIG. 1.

view of the same thing made up in a simpler form, is shown in Figs. 2 and 3. The anode described stands to the right in



FIG. 2.

Fig. 2. It consists of a piece of glass tubing, 8-in. by $\frac{1}{2}$ -inch, joined to a 1-inch piece of capillary tube. The capillary should fit as closely as possible to

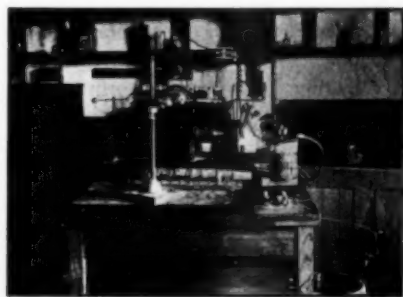


FIG. 3.

the piece of platinum, but must be large enough to allow free movement through it. No. 18 platinum wire is large enough for currents up to ten amperes. This wire is soldered directly to the end of a

brass rod, threaded at its upper end, where it passes through the brass stopper. Its upper end is provided with a milled head for adjustment. The vital point of the apparatus is where the rod passes through the stopper. All the connections here must be air-tight, as the liquid inside the tube shows a very marked tendency to rise and would rise to a height of several meters if the tube were large enough. The only way I know of to stop this, is to make all connections air-tight. The liquid inside does no harm, but if allowed to rise and flow over the top, it forms a conducting path and the interruption ceases.

A simpler form is made by merely passing the brass rod through a closely fitting cork. This form of interrupter will last until the platinum is eaten up and seems to be free from the faults of most other kinds.

Another difficulty is due to the fact that the liquid in the jar heats up quite rapidly. If the jar is of about gallon size this will usually not take place rapidly enough to do any harm. If, however, the apparatus is to be used for long periods, it is best to make the cathode of a coil of small lead pipe, both ends being left outside the jar. By passing cold water from the top through the coil, the temperature is kept down. The slight grounding is generally harmless, providing a rather long rubber hose is used to make the connection to the top. It would hardly do to use a metallic connection.

Fig. 2 shows this arrangement applied to the Caldwell Interrupter. This is composed of an inner and an outer glass jar, the inner one of thin glass. The diameter of the inner jar should be seven-tenths that of the outer. The bottom of the inner jar is pierced with a hole from one to three millimeters in diameter. A fine, tapering glass rod is sometimes used to adjust the size of this

hole, but the break is not so sharp as with the plain hole. It is best to use a jar pierced with several holes, and means to stop up tightly all but the one in use. Both anode and cathode are preferably lead. Personally, I prefer the Caldwell Interrupter in direct currents, the Wehnelt in alternating.

To work with alternating currents, this is all that is required, but if work is to be done with direct currents, we require an inductive and a non-inductive resistance. The former consists of a coil of about one hundred turns of No. 18 wire, wound on a core of iron wires about 8 in. by 1 inch. Taps should be brought out so that from ten to the full number of turns can be connected in the circuit.

As a non-inductive resistance, I use a ten-gallon jar of water with two carbon rods dipping in on opposite sides as electrodes. Enough salt is thrown in to bring the water to the right conductivity, and the finer adjustment is made by moving the carbon rods. The complete apparatus is shown in Fig. 3. The whole outfit should cost but very little to have made, or it can be readily constructed by the user.

Fig. 4 shows the connections for use, with the direct current. The interrupt-

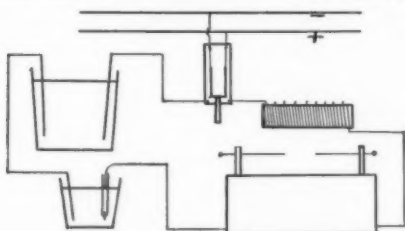


FIG. 4.

er, the coil, the inductive and the non-inductive resistances, are connected in series with the mains through the switch (the order is immaterial,) and a fuse is inserted to avoid blowing the main fuses. The ordinary vibrator is screwed up tightly so it can not act. The voltage of supply may be anything from 100 to

250 volts. I have not tried higher voltages, but they might work well. Care should be taken that the wiring is heavy enough to carry the current used, but special wiring will usually not be necessary.

The strength of current is regulated by the water rheostat and, to some extent, by the amount of platinum exposed. The frequency is increased by decreasing the number of turns of inductive resistance and by shortening the platinum point. Usually the frequency should be as high as the interrupter will allow and work well.

If the alternating current of 125 or 60 cycles is available, it is far preferable to the direct current. Here, if the voltage is about 110, which is practically always the case, it is only necessary to connect the interrupter and coil directly in series across the line. This is exactly the same as for the direct current, except that the inductive resistance and the liquid resistance are left out entirely. The amount of current is regulated by the projection of the platinum point. The frequency is now fixed by the frequency of the alternating current and can not be changed. A number of curves of the current waves which I have taken, show that one interruption takes place in each positive wave, i. e., in each wave of current from the platinum point to the lead plate. No interruption, or only a partial one, takes place during the negative wave.

This makes an exceedingly convenient arrangement. Only one adjustment is necessary, that of the projecting platinum point. As was said before, the number of interruptions per second, can not be changed. This may be thought by some to be a disadvantage, but in practice I do not find it so. I may be mistaken, but I am strongly of the opinion that the frequency of the discharge has nothing whatever directly to do with the radiation of the tube, any more than

it has in an incandescent lamp. In both cases it is the total current passing that produces the radiation. In an ideal interrupter we would be able to make the number of breaks per second anything we choose, without changing the rate at which any one interruption takes place. That is, we ought to be able to get one break or one thousand per second, and have the actual breaking of the current take place in the one in precisely the same time as each of the one thousand occupied. This would be desirable, but it has never been reached or even approximated in practice. In the ordinary induction coil vibrator, if we decrease the rate of vibration, the separation of the platinum points takes place more slowly, and the E. M. F. generated in the secondary, is consequently less. The same thing holds in the rotary break or any of the mercury interrupters. The practical result is that we can not reduce the number of interruptions per second to a low number. The only place where this would be of any great advantage would be when we wanted a strong radiation, but could not run constantly on account of heating of the tube. Then it might be better to have a few strong flashes per second. But this necessity can be avoided by using the tube adapted to heavy currents.

One advantage of using the alternating current, is that the interrupter "works" better with the direct current; if the interruptions are very fast, the action is likely to stop. The interrupter gives off a curious sucking sound and the point turns red. On opening the switch and again closing it, the interruptions will again begin to take place. Now, with the alternating current the current is stopped and started 125 times per second. Consequently, if one interruption is missed, the next will probably take place all right. Hence, the interrupter being once started, the action

will continue indefinitely.

With the alternating current the discharge through the tube or over a wide air gap, is unidirectional. This is due to the fact that the interruption takes place only in the positive wave. The E. M. F. due to the regular alternation, is not sufficient to bridge the gap or pass through the tube. Consequently, with this arrangement we use a single focus tube, although operating the coil with the alternating current.

If the Caldwell Interrupter be used, since it is symmetrical in arrangement, interruptions take place in both directions. Consequently, the secondary discharge is alternating and we must use a double focus tube. This requires, however, a rather high voltage, and I have not succeeded in making it work well on 110 volts.

TUBES.

The tubes used in this work must have rather a high vacuum for two reasons. In the first place, if of too low resistance, the inverse E. M. F. is sufficient to send some current through the tube and the definition is impaired. Moreover, if of low vacuum, too much current passes through, and the anode will become red-hot in a few seconds. It must be remembered that we now have 125 discharges per second, when with the ordinary vibrator, screwed up tight for great spark length, we get only five to ten. The heating effect is therefore, ten to twenty times as great. An old tube, whose vacuum has become so great that it is useless for ordinary work, is excellent here.

Ann Arbor, Mich.

[To be continued.]

The greatest evidence of a doctor's fitness to do x-ray work is shown by his reading the AMERICAN X-RAY JOURNAL, and conversely if he does not read it he is trying to do the impossible, for he can not have the facts for best work.

April 1901



THE PATRON SAINT OF THE STATIC MACHINE.

The inventor of the Mica Plate Static Machine, Rome V. Wagner, M. D., is well known in all branches of electrical work pertaining to Physicians and Surgeons, but the rapid rise in popular favor of his Static Machine ranks him as the Patron Saint of Statics. Have you seen his X-Ray talk, gotten out by R. V. Wagner & Co., Chicago?

RENAL CALCULUS.

BY J. N. SCOTT, M. D.

Lecturer On Electro-Therapeutics University Medical College.

Fig. 1 shows a calculus in the right kidney, $\frac{3}{4}$ in. in diameter. The radiograph is of a female child $3\frac{1}{2}$ years old. Details of making the radiograph:

Apparatus used consisted of three 12 inch spark induction coils connected in series, and capable of giving a 30 inch spark of large volume. The secondaries are wound with No. 32 wire. Current used. The apparatus was attached to the 110 volt direct current, with an adjustable

of the adjustable shunt spark gap. Position of patient—the patient was placed on her back, with tube over the median line at a level of the iliac crests. Time of exposure, 7 minutes. Tube distance from plate, 20 inches. Thickness of body on a line with calculus, $5\frac{1}{2}$ inches. An anesthetic was used during exposure because child would not remain quiet. Plate used, double-coated x-ray Developer, metol hydrochonon. The child had symptoms of calculus but it was uncertain whether it was in the kidney or bladder.

Fig. 2, Radiograph of a man 36 years old, showing calculus, in right kidney.



FIG. 1.

German silver rheostat in series. The current through the primary was flowing at the rate of about 18 amperes, but was varied according to the amount of secondary current the tube would take. Tube used, was the General Electric Co. funnel focus with vacuum regulator. Vacuum—the tube would back up a parallel spark 2 inches long. Spark gaps—the series spark gap was $1\frac{1}{2}$ inches long. A shunt adjustable gap was used as a fine regulator of the current in the tube, more current was used than the tube would take continuously without melting the anode, and as soon as the anode would become too hot, the current was cut off for a few seconds by means

Apparatus, tube, current, etc., used, same as in description of preceding radiograph. The patient was placed on his back. Position of tube was directly over the right kidney. Time of exposure was 11 minutes. Tube distance from plate 26 inches. Thickness of body on a line through kidney $12\frac{1}{4}$ inches. Plate used, double-coated x-ray. Developer, metol hydrochonon.

From reports of cases the general methods used of locating a calculus is to use a tube of as great penetrating power as possible, make the exposure short, varying from a minute to three or four and obtain really an under exposed plate. The claim is made that if you

expose longer you will penetrate the calculus to such an extent that its outline will not appear on the negative. I have tried all lengths of exposures from a few seconds up to 20 minutes and my most uniform results have been obtained by the following method: I use a tube which will give off the largest volume of ray possible with only enough penetration to obtain a normally exposed plate for the given thickness in from 10 to 13 minutes in an adult according to the thickness of the patient. In developing

tube as possible without melting a hole in the anode or lowering the vacuum. When we use the large volume of ray which will just penetrate the soft tissues and effect the plate in a reasonable length of time, we have a ray which will penetrate a substance a little more dense than the surrounding tissue to the same extent, and I think will give more contrast than a more penetrating ray. I think that a ray with high penetration and small volume will give less graduation between parts of nearly the same



FIG. 2.

the plate I develop to obtain as much detail as possible. In order to obtain the large volume of ray I use a tube capable of taking a large quantity of current. To do this the anode must be made of thick hard platinum or irido-platinum, preferably backed with aluminum or the funnel shaped platinum anode, which instead of scattering the rays in all directions in front of the anode, as is the case when the flat one is used, concentrates them into a small area, and having a large surface it radiates the heat rapidly. I pass as much current through the

density than one of large volume and low penetration. This can be illustrated by taking a number of pieces of pasteboard placed on a large piece, making 1-2-3-4-5 and 6 layers, making two radiographs of them; for one exposure use a high vacuum tube and the other a low vacuum. Use the same quantity of energy in both trials. The one taken with the low vacuum will have the finest gradation of shadows. I also find the above described method the most satisfactory for bringing out consolidated lung tissue in a radiograph.

Kansas City, Mo.

EFFICIENT AND NEGLIGENT PRACTICE.

This little history well represents the condition of our profession and the laity.

The skiagraph marked No. 1, represents the condition of a fractured thigh taken a few hours after injury. The Southern Railroad seems to be to blame for the accident, for they settled a claim for damage. The surgeon of the road,

dition before the responsibility was assumed. He properly used a temporary dressing and sent the patient to his home and in due time made preparation for a permanent dressing. The latter he was prohibited from doing, however, because the railroad company refused to assume responsibility and the father of the patient chose his family doctor. Doctor No. 2 asked to see the skiagraph

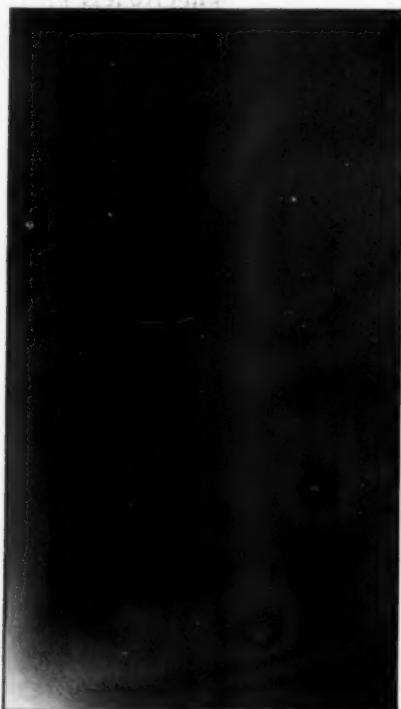


FIG. 1.

Dr. Geo. Bazemore, acted with promptness and foresight characteristic of a true surgeon in obtaining the best skiagrapher in the State to picture the accident as it actually existed in the person he was called to treat. He did not call for kodak pictures of the box cars and extraneous things in proximity, about the only thing that interested the people—the officials of the road and the court, heretofore. The doctor was interested in the case and desired to know its con-



FIG. 2.

that had been taken, but without authority of the other physician and was therefore properly denied. Nine months after the accident the thigh has the appearance as seen in Plate No. 2. The doctor used good judgment in trying to get a view that had been taken and it is quite possible that the patient could not bear the expense of an x-ray examination. This should have been a simple case and without the x-rays methods are known that are positive, equally with

the light to guide the surgeon. But as we have before pointed out: all injuries should be skiagraphed as soon as possible, once or twice during the process of repair and when the case is dismissed. This is a record and justly defends the doctor, the patient and others interested. The very moderate prices made by Professor Horner for such work would not much encumber a doctor though his case was poor. It is these cases that often worry us so much.

In connection with this case it is proper to say that the officials of the Southern Railroad have shown a kindly disposition towards the use of the x-rays with the injured of the road. The employment of Professor Horner to do the work for them assures proof of the picture in case of litigation. He thoroughly understands the use of the Fluorometer and can with this instrument for correcting distortions, go into court with positive evidence, and no court can throw him down, for he is armed with the evidence of truth, and the simplest language conveys the facts understandingly. Physicians and corporations should everywhere recognize these truths and accomplishments.

DETERMINING DEATH BY X-RAYS.

"Prof. Ottolenghi, of the University of Sienna, has discovered that while it is easy to apply the rays to the lungs of persons who is alive or in trance, it is extremely difficult, indeed practically impossible, to apply them to the lungs of a person actually dead. The reason was that some intervening obstacle prevented the rays from penetrating into the body. Over and over he made a test of this kind and in each case the result was the same. He suggests that as this test can easily be made by any physician, it should in future be employed in all cases where doubt exists of death."

ROENTGEN SOCIETY OF THE UNITED STATES.

ANNOUNCEMENT OF COMMITTEE ON ARRANGEMENTS.

The Committee on Arrangements for the next meeting of the Roentgen Society of America have secured, through the courtesy of the Dean and Faculty of the University of Buffalo, the use of as much of its building as we may require. The location is central, the room ample and on the ground floor. The date of the meetings will be Sept. 10 and 11 at the University of Buffalo, Buffalo, N. Y.

The following rules and regulations in regard to exhibits have been adopted by the committee: Applications for space should be sent as early as possible to R. C. Adams, Secretary, Drawer No. 963, Buffalo, N. Y., with particulars as to character of exhibit and space needed.

Exhibits may be consigned to Louis Staffeldt, care University of Buffalo, and all express and freight charges must be pre-paid. Owners of goods sent by freight who wish them transferred to place of meeting on arrival, must notify the secretary and send him the pre-paid bills of lading. The cartage will be at expense of owners.

Exhibits are wholly at risk of owners, and should be unpacked and installed by them not later than Sept. 7.

Alternating current 104 volts, single phase, 60 cycles, and direct current 110 volts, will be available, also dark room for photographic purposes. A nominal fee for current and floor space will be charged proportional to amount required.

All exhibits must be removed by Sept. 13.

EDGAR B. STEVENS,
Chairman.

ROGER COOK ADAMS,
Sect'y., Drawer 963.

DR. JAMES W. PUTNAM,

DR. ELMER E. STARR,

DR. RENNICK R. ROSS,

Committee.

ROENTGEN SOCIETY.

The following notice, made by Professor Monell, Chairman of Committee on Standards, appeals to all persons whomsoever, that have any knowledge on this subject; and commends itself especially to medical men having interest in the attainment of more knowledge. Write to Dr. Monell and give expression on one or more of these subjects.

COMMITTEE ON STANDARDS.

DEAR SIR:

To promote uniformity in results and to secure accuracy and give legal value to the evidence of x-rays, it is necessary to standardize methods of doing the work. To this common benefit all x-ray experts are asked to contribute for the general good of the cause. You are therefore invited to write me your best suggestions on such of the following points as you can offer advice upon:

A standard uniform nomenclature for the principal terms required.

A standard form of record—blank for briefly filing reports and indicating all essential details of the exposure.

Standard of efficiency for tubes.

Qualities which a standard x-ray photographic plate should possess.

Qualities which a standard x-ray fluoroscope screen should possess.

Standard handle for all x-ray tubes so they will fit a standard tube-holder.

Standard tube-holder to fit uniform standard tube-handle—adjustable, rigid, holding tube without vibration—and convenient for general use.

Standard position of tube for correct shadow.

Standard distance of anode from plate for standard x-ray exposures.

Standard exposure times for chief parts of the body with a standard radiance.

Standard measure of different degrees of x-radiance.

Standard "skiameter."

Standard x-ray examination table, adjustable for all parts of the body.

Standard method of posturing each part of the body for a standard picture.

Standard means of fixing parts immovably during a standard exposure.

Standard complete definition of what a "standard exposure" should be. (Of medico-legal value.)

Standard landmarks to be pictured in the negative as inherent proof that a standard exposure was made—(a medico-legal necessity).

Standard method of localization for both "skia-graphy" and "fluoroscopy," which shall be the most practical, quick and uncomplicated.

Standard technique for picturing correct relation of bones and joints.

Standard technique for picturing details of any kind sought.

Standard technique for picturing contrast for diagnosis of soft parts.

Standard technique for picturing the different calculi, vesical, renal and gall-stones.

Standard technique for x-ray dental diagnosis.

Standard technique for x-ray eye work.

Standard technique for x-ray heart and lung diagnosis.

Standard treatment of plates to develop uniform results.

A standard leaflet of brief directions which the physician who does not do his own developing can send with his plates to any fair photographer as a ready guide to proper treatment of an x-ray negative to secure the picture.

Standard technique for therapeutic administration of x-rays with proper precautions.

You are invited to supply any omitted detail which you believe should be standardized. Will be pleased also to have you select one or more features of the above list in which you have had special experience and make a careful report upon what you regard as the proper standard to officially adopt. A reply is desired in about two weeks. In offering suggestions about standard working methods, postures, special devices, apparatus, etc., it is desirable that you send explanatory camera-photographs illustrating the details for comparison. Thanking you for your professional co-operation in behalf of the committee, I remain, Fraternal yours,

S. H. MONELL, M. D.,

Chairman of Committee on Standards,

47 West Twenty-seventh Street,
New York City.

DETECTING SIGNATURES BY X-RAYS.

In the state archives at Rome, says *Electricity*, it has been found that the x-rays may successfully exhibit writing on manuscript concealed in the old book covers whenever this writing is done in red lead, ultramarine blue, or cinnabar. They are being used also in attempts to detect forgeries of paintings and in efforts to discover signatures of old masters in paintings alleged to have been produced by them.

DEPLORABLE.

On page 45 in "Roentgen Ray in Spanish-American War" we find the following:

"The superiority of the Roentgen ray over other methods of locating lodged missiles is so great that, when available, it should be used to the exclusion of all others."

This is not new, but is recognized by all worthy surgeons throughout the world, now, as a tenet in surgical practice. But how is it with surgeons not far away? We have had reported to us the case of a young man who had been shot, the bullet entering the orbit. Some days after the injury the head was trephined and search made for the bullet. The dangerous probe was used. The patient died. In the post-mortem the bullet was found to have passed downward and outward beneath the zygoma and was lodged just under the skin. In another case: A surgeon (?) used the dangerous probe about the neck of a patient trying to locate a small bullet, although he himself was the possessor of an x-ray apparatus. The operator may have had trouble heretofore in finding missiles after seeing them with the x-ray and therefore returned to the dangerous probe. He does not use the fluorometer in his x-ray practice. Further:

"With the Roentgen ray at hand, the surgeon can locate a lodged missile at any time when necessity demands, and its track can be left safely undisturbed."

Another case: A fine nail entered the metacarpal joint of the thumb of a young lady and after much ado the surgeon (?) with assistants made a poor dissection of a large portion of the palm, and failed ingloriously. The nail was found with the x-ray to be beneath a sesamoid bone of the thumb. Another case: A bullet entered the palm of a boy's hand near the wrist and passed upwards. The surgeon (?) used the dangerous probe and thinking he had reached the

bullet made an ugly wound in about the middle third of the forearm. The x-rays after this cutting revealed the bullet in the elbow joint near the coronoid process. Further:

"With the probe it is possible to follow only a small minority of bullet tracks."

This is a fair specimen of what is going on although the AMERICAN X-RAY JOURNAL is published in St. Louis notwithstanding. We acknowledge it does not speak well for us.

LABORATORY OF PROFESSOR BOUCHARD.

Among the researches made at the Laboratory of Professor Bouchard, of Paris, we have received a book of five chapters contributed by Dr. H. Gilleminot, embracing the following subjects:

Chapter I. Radioscopic examination of the subject. Under this head we described two kinds of apparatus which are said to satisfy all the needs of the clinician, one being designed to examine the patient in the vertical position, and the other while lying down.

Chapter II. Treats of the point of incidence in clinical radiography and is amply illustrated to elaborate the views of the author.

Chapter III. Describes minutely the advanced methods of locating foreign bodies, with a view to exact operations for their removal.

Chapter IV. Describes apparatus for radiographing the rhythmic movements of animated organs, and advances a method of cinematographing of the thoracic organs.

The article by J. Rudis-Jicinsky of Cedar Rapids, Iowa, entitled "Gallstones under the x-rays," printed in the AMERICAN X-RAY JOURNAL, February, has attracted a great deal of attention for the reason of the clear practical method given "how to find the stone". It is this simple way of telling how a thing is done that makes an article useful.

A STUDY OF STATIC ELECTRICAL APPARATUS.

BY JOHN TOWNSEND PITKIN, M. D.

ARTICLE NO. 1.

From the history of electricity we learn that the static variety or degree of electrical energy was the first to be investigated and utilized.

That one *Otto von Guericke, the jocund burgomaster of Magdeburg, in Germany, constructed the first static machine, consisting of a revolving ball of sulphur rubbed by the hand of the operator. Through this invention he gave birth to the progenitor of all dynamo and static machinery, the former being only a modification of the latter.

In course of time the more simple forms of dynamos evolved into engines of power, so that they moved the levers and engines of industry and transportation. By transformation of their electromagnetic currents they illuminated our streets and buildings, supplied us with heat for manifold purposes and placed us in electrical touch with our neighbors and remote portions of our continent, even the lands beyond the sea, while their parentage was forgotten and static electricity only employed as a plaything or scientific curiosity.

When men of science became aware that all living organisms require a given static electrical potential for their health, comfort and maintenance, and for reasons already pointed out through the columns of this valuable journal, that the ideal excitator of the Crooke's tube for the production of x-radiance is static electricity, the scene changed and the static machine so long neglected, was taken from obscurity, improved, transformed, and has become the healer of diseases which baffle all other methods of treatment, and with its x-ray searchlight has made the practice of surgery and medicine approach more nearly to

an exact science. An eminent instructor of surgery advises his students to always carry the bones of the human forearm in their (mental) pockets. The Leyden jars of the static machine should be similarly cherished by all x-ray workers.

For, barring the fact that the static apparatus is self-exciting and capable of maintaining continuous activity, it is but a large Leyden jar of diversified construction.

Hence, it follows, that a static generator having two ordinary condensers attached, may be considered as three Leyden jars variously connected.

When, as is the usual arrangement of the jars, their inner coats are connected one to each of the arms of the prime conductors of the static generator and the outer coating rests upon a wooden shelf or bracket, short circuits will form between the two jars and the jars and the machine proper, during functional activity, thereby reducing the amount of otherwise available current required to operate a Crooke's tube placed in simple series. The current wasted will increase with the amount of resistance offered between the discharging rods of the prime conductors. Thus the loss is greatest when a strong current is most desired *e, g,* for the excitation of a tube of high vacuum and great efficiency. Placing a glass or porcelain dish beneath the jars, very materially lessens the leakage, but even then, with powerful generators, discharges will often take place between the external and internal coatings of the condensers or the external coats and other portions of the static apparatus (most frequently on the positive side). The discharges may be sudden or disruptive, accompanied with considerable noise, convective or silent, or a creeping of the current over the intervening glass surface may occur, when allowed to become dusty or covered with little particles of elementary carbon. Such discharges often disturb timid pa-

*See Intellectual Rise in Electricity. By Benjamin.

tients undergoing examination rendering them unsteady. They also lessen the volume of current passing through the tube, cause the x-ray light to flicker and efface some of the finer details from the sensitized photographic surface. The most effectual means of arresting this form of electrical loss is to fill the jars with crude petroleum and then place them in a deep outside retaining vessel, made of glass or porcelain and filling all intervening space with the same oily insulator. Thus immersed, the electrical charge of the condensers is retained upon the metallic coatings and the danger of piercing the dielectrics reduced to a minimum. To operate the jars as static transformers, the external coats may be electrically connected to each other by a metallic chain the ends of which are dropped into the outer retaining vessel.

Placing the outside coat of a single Leyden jar in contact with woodwork of an apartment increases the capacity of the condenser by enlarging the extent of chargeable surface. The effect is the same as if the external coat had been made greater, but when two or more jars are dissimilarly electrified and then allowed to touch the same woodwork their respective charges will intermingle and neutralize each other with considerable loss of energy.

Similarly if it were possible to connect one side of a static machine with the floor of the operating room without, sustaining leakage from the other side, the capacity of the machine would be considerably augmented, but the imperfect insulation of the average static machine renders that practice impracticable. As it is impossible to pump electricity from the static machine into the ground or from the ground into the machine, which the expression "grounding of the apparatus" would imply, the employment of this misleading expression should be discontinued. Buffalo, N. Y.

CORROBORATIVE EVIDENCE NECESSARY.

In his admirable address, on taking the chair as President of the Roentgen Society, London, Dr. John Macintyre of Glasgow, after briefly stating the eight conclusions of the American Surgical Association on the medico-legal aspect of the x-rays mildly said: "It may here be pointed out that where doubt it expressed the findings of this or any other association may be required to be changed any day; they do not stand for all time. By way of comment further, we may emphasize the point that in every branch of science corroborative evidence from every other source should always be obtained; that every x-ray photograph does not reveal all that could be revealed by photography, and that sometimes the best results can be only obtained where the surgeon combines in himself professional knowledge with that of the expert in x-rays." He also calls attention to the fact that the Association omitted in their discussions the value of stereoscopic observation by plate or screen. If Dr. Macintyre had read Dr. Kelly's observation on the "lukewarmness of the Association on this most important subject," he would not have been surprised with the proceedings. There is another thought which is especially noticeable in one of the conclusions of the committee which is very commendable and characteristic of the advanced surgeons of our country: "That the surgeons should familiarize themselves with the appearances of photographs, their distortions, and the relative value of shadows and outlines, so as to be able to judge for themselves and not have to depend on the interpretation of others who may lack surgical knowledge necessary for a proper interpretation."

Subscribe now for THE AMERICAN
X-RAY JOURNAL.

LYNN, MASS., Feb. 11, 1901.

Dr. Heber Roberts, 301 Chemical Building, St. Louis, Mo.

MY DEAR SIR:—In regard to the projection of x-rays from the anode of a Roentgen-ray tube, in answer to your inquiry of Jan. 30, I would say that the rays are in reality projected in much larger amount from a spot—which is not a point but a perceptible area—towards which spot the cathode rays are thrown from the cathode. This spot may be considered in most cases to be about 1-32 to 1-16 of an inch in diameter, though in many cases it exceeds these dimensions. If it were a point the definition of the Roentgen-ray picture would be excellent even at very small distances from the tube, but it is well known that to get sharp pictures it is requisite that the distance be not too short, since the further away we are the more rays will appear to emanate from a point, though in reality coming from a disk or circle.

While it is a fact that most of the rays in a well constructed tube come from a bombarded spot on the anode, it is also a fact that in no tube do all the Roentgen rays emanate from that spot. There is a scattering action and diffusion which causes other parts of the anode to emit rays feebly, and even the glass parts of the tube take part in this feeble emanation. The expedient of a circular diaphragm, i. e., a metallic sheet such as a sheet of lead with a hole cut in it, is often resorted to, to cut off these extraneous rays and limit the used rays to those emanating from the anode spot (or bombarded spot) alone. This improves the general definition, or lessens the tendency to blur.

Roentgen rays, however, in traversing tissue or any substance more or less transparent to them, undergo a scattering or diffusion, i. e., they set up secondary ray emanation in the tissue itself, and of course this ray emanation is in all

directions. It is for this reason that it is so difficult to obtain a clear definition on a screen or photographic plate through the thicker parts of the body. This diffusive action may also be diminished to a large extent by the employment of diaphragms, allowing just such a cone of rays to pass through as are concerned in the particular examination under way. This fact has been emphasized by Dr. F. H. Williams, of Boston, I believe, in some of his papers on the use of the x-ray in delicate examinations of the thoracic viscera.

Very truly yours,
ELIHU THOMSON.

SEEHEAR.

Rollins, in the Electrical Review, N. Y. City, Feb. 2., has given an account of the seehear and stethoscope with two new features, one a sound chamber, the other a fluorescent screen. The seehear has the advantage in hearing the sounds in the chest of a patient while the organs are under inspection of the x-rays. In vol. 5, No. 1, July issue of the AMERICAN X-RAY JOURNAL, 1899, three pictures were given of the seehear by the same author. The first picture showed the seehear, the second picture showed the seehear in use by physician and the third showed the seehear in use.

It is well known that within the past few years by the use of the Air Drill and the Electric Drill the cost of gold mining has been reduced from 50 per cent to 90 per cent; that by improved machinery and the chemical processes the extraction of gold and silver from the ore has also been equally reduced; that all items of expense connected with mining have been so materially reduced that mining has passed from the condition of being a mere venture to that of the most profitable occupations. Money now put into a conservative, legitimate mining company is not a "gamble" but is an investment.

UNSOLVED PROBLEMS OF MEDICINE.

Dr. George F. Shrady, the talented editor of the great New York *Medical Record*, and eminent surgeon, has recently written on the "Unsolved Problems of Medicine" in which he refers to the advantages of the x-rays and especially mentions "that President Garfield would never have died from Guiteau's bullet had the Roentgen rays been discovered at that time." In writing upon any question in medicine it is customary to cast aside figurative speech and speak at least relatively. I would judge, however, in this instance Dr. Shrady had indulged a little, for I take it that he had seen many articles on the "fallacies of the x-rays" written by men to the front in medicine, and according to precedent had the right and license to write upon innovations, though but feebly understood by them. Then, if he had read these articles he must know that the bullet shot into President Garfield was deep seated, as it was found encysted on the splenic artery and near that organ. Dr. Shrady himself, I believe, was one of the surgeons in the case. The bullet was probably $3\frac{1}{2}$ inches from the surface at the nearest point. Now according to these learned writers upon the fallacies of the x-rays in diagnostic medicine, the surgeon seeing the bullet either in subject or on plate would in cutting have to search for the bullet. Its proximity to vessels and nerves would have necessitated the infliction of serious injury groping in the dark, enough of itself to hazard the patient's life. Recently one of the Ex-Presidents of the American Medical Association, under his own signature, wrote of the difficulty he encountered in finding the bullet in a knee, so fallacious were the x-rays. But I am inclined to believe that Dr. Shrady has had some good information on the correctness of the x-rays. If the doctor is

writing with this view in mind then he is correct, so far as locating the bullet mathematically is concerned. This is true. No one is honest with himself or with his patient who attempts to locate foreign matter within the body without having the devices and the understanding how to correct distortions. Thus fortified the good surgeon would have gone directly to the bullet soever deep it may have been.

The Illinois School of Electro-Therapeutics of Chicago has far exceeded the expectations of its incorporators. Within one year their space has been doubled and their faculty increased. The fact that this is the only strictly ethical school of its kind for physicians should make it popular with the profession. At a recent meeting of the board of directors it was decided to advance the price of instruction after May 10, 1901, except to those who matriculate prior to that date. This matriculation fee will be deducted from the price of the course when taken and allows such students to enter at any time during the year.

Write for bulletin of information, 1301-2-3 Champlain Bldg., Chicago, Ills.

Stringtown on the Pike, by John Uri Lloyd, is an interesting story of country life in Kentucky, beginning in the stirring times of '63. The author is especially successful in his portrayal of the different characters. The love Sammy Drew and Redhead bore Susie and their hatred for each other; the superstition, cunning and faithfulness of Cupe; the Parson's peculiar power to force the confession of murder from the Colonel and his swift vengeance; the refusal of Mr. Manning to own his child and the result thereof; the hope for gain; the thirst for revenge; all of these show a deep insight into human nature. It is in short an extraordinary story of ordinary people.

HOW TO DIAGNOSE INTESTINAL OBSTRUCTION.

BY DR. J. RUDIS-JICINSKY.

The diagnosis of intestinal obstruction is nearly always one of the most difficult. The site of the occlusion can rarely be determined positively by the usual methods of diagnosis. A careful study of the case along with the different causes producing the affection ends very often negative. Prognosis in these cases is grave, but guided by the cause. Strangulations, invagination and twisting give not very favorable outlook always. Collapse may occur sooner than we might expect in such a sudden or gradual closure of the intestinal canal. But the case may be diagnosed soon and absolutely correct if we apply the x-rays in time. I have made few experiments in this line, just to see what can be done for those who suffer from intestinal obstruction. I have produced an artificial obstruction in the intestines of three dogs, one strangulation, one twisting and one produced by a foreign body not opaque to the x-rays. In all the cases the exact condition of affairs could be made out in three hours with the help of the x-ray. I gave for the purpose of diagnosis to each dog a pill, which after elapse of few hours could be seen on the plate of the fluoroscope and traced gradually to the point of the obstruction in the intestine. It was not necessary to take a skiagraph. The diagnosis in each case was verified. Encouraged by these results I have tried the pill myself just to see if it will pass freely, being not affected by the juices of digestion. It passed in two hours without any discomfort to me. The pill is prepared specially. Take a gelatine capsule No. 3, put a No. 4 shot into the same, close the capsule and cover the whole surface with a smooth layer of dental gutapercha, which must be applied warm, certainly. This way you

will get a nice pill, which may be easily swallowed and the gastric juice can not act upon it. The shot being opaque to the x-ray will show plainly and may give you the direction in which the strangulation took place. Such a diagnosis is correct and may solve the problem of immediate operation, if necessary. I made few skiagraphs in succession, tracing the pill in my own body, and I assure you the procedure itself was very interesting.

Cedar Rapids, Iowa.

Lambert Pharmacal Co. has recently printed a brochure on the medical and surgical experience of the South African War, which was addressed to the Toronto Clinical Society and Canadian Medical Association, by Lieut.-Colonel G. Sterling Kyerson, M.D. The subject is an interesting one to physicians and the contents exceedingly instructive. A review of the nature of diseases which prevail in that country and a comparative mortality from the same nature of disease in other wars in other countries is given. This same attention is paid to the surgical aspect of the war. It appears from the tables that more doctors are now needed in war than surgeons, which is contrary to all previous wars. This seems strange in the light of modern ingenuity being liberally paid for inventions to more effectually injure and destroy human life. Some explanation for this great change may be made in diagnostic medicine furnished by the x-rays.

The Aristos Gold Mining and Milling Company give for reference the First National Bank of Denver and the firm of Patterson, Richardson & Hawkins, the company's counselors. Mr. Patterson is the newly elected U. S. Senator from Colorado. He has been Mr. Lamb's attorney for over twenty years. Mr. Lamb is president of the company. Read the advertisement in this issue.

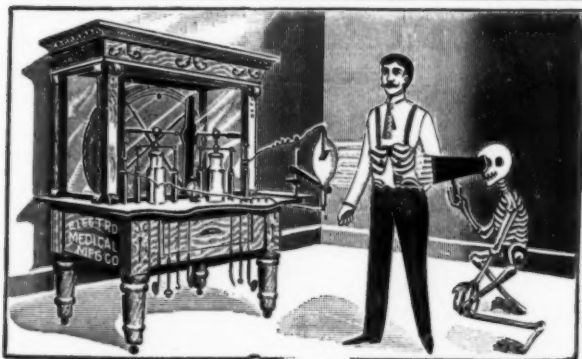
THE CROSSING OF X-RAYS.

In answer to an inquiry upon this subject, Professor Thomson very kindly gives the following:

If you will notice the shadows cast by the sun, which is not a single point but a disk of light, you will find that the shadows are only sharp when the surface upon which the shadow is cast is near to the object, in fact a shadow cast in sunlight by a small object (like a small shot) very soon disappears, and this is owing to the crossing of the rays from the different points of the sun around the edge of the object, and since these rays move in straight lines the edge of the object becomes, as it were, the pivotal point for the rays.

There is also another action in case of sunlight, which is absent in Roentgen rays, i.e., diffraction, which tends to bend the rays around the edge of the object. For sharp shadows formed by Roentgen rays the tube should be as

far from the object as possible, and the object should be as near to the screen or photographic plate as possible.



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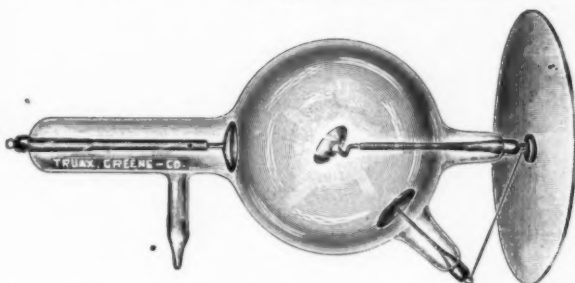
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This hotel has been selected as the official headquarters of the annual meeting of the Roentgen Society to be held in September, and members are invited to address Mr. F. E. Schenck, the manager, for reservations and any information.

The Editor of this publication takes pleasure in recommending the Park Hotel.

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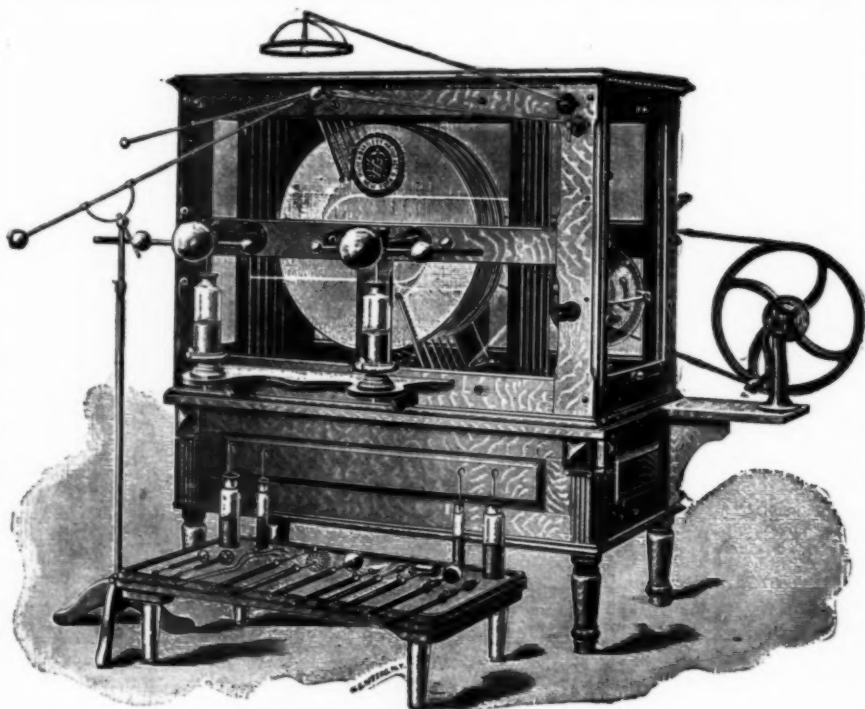
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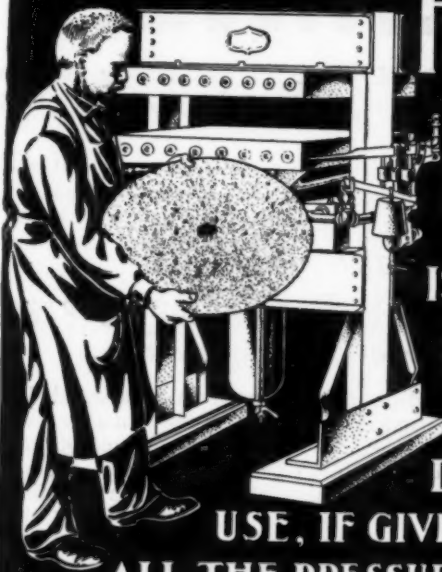
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